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THE ROSE TECHNIC.

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IT is always a two-fold pleasure for an editor to announce the advent of new talent upon the staff, a pleasure to contemplate the diminution of work and the improvement of the journal, an everlasting joy to find another item of news.

Verily the fates have dealt kindly with us, for we are now enabled to announce two additions to THE TECHNIC staff, since Messrs. J. J. Kessler and H. D. Gerwig have accepted positions as associate local editors, and will share with Mr. Liggett the burdens of that department. It has been customary to leave a vacancy in the local department to be filled after Christmas by a member of the Freshman class. Mr. Gerwig has been elected to this position and will represent his class in the management of THE TECHNIC. We hope his classmates will feel that they have an interest in THE TECHNIC and will aid him in making the local columns of our paper teem with the records of their Freshman days, which are full of the novel experiences of college life and are often the most pleasurable to recall in after years. Many of the students keep their TECHNICS as souvenirs of their college days and many a paragraph will perpetuate the memory of some happening or vividly bring to mind some forgotten jokes.

The majority of occurrences in our college life cannot be considered as being news to the students, since all are aware of them, but they should appear in our college journal that it may be a complete reflection of the life of the Institute.

With the intention of enlarging the local department it was decided by the board that another editor was necessary and accordingly the constitution was amended to that effect. Mr. Kessler was then elected to the office thus created. It is hoped the standard of our local department will be considerably raised under the management of these gentlemen and that they may receive the hearty co-operation of the students.

* * *

AT the present season of the year the Sophomore and Freshman classes are closely watching each other in the hope of catching some clue of approaching banquets. The time honored pleasure of kidnapping the toastmaster or in other ways disturbing the peace and quietness of each other's celebration is of course too great to be renounced. Nor would any college man who is aware of the inherent pleasures of such jokes seek to have them otherwise. But there is a marked difference between a faculty reception and a class banquet, a difference which should be respected. If the faculty receptions are to be perpetuated then the present classes are now inaugurating customs which will be incident to such social gatherings in the future. It is to be regretted that there is a tendency to treat these receptions in the manner of class banquets, to make it a matter of conjecture whether a man will be enabled to appear on the scene in a dress coat or with no coat at all; whether he shall be allowed to arrive at the ordinary time, or have the pleasure of sauntering into the parlors in time to see the electric lights snapped out, and perhaps to hear issuing from the darkness "You's done come too

late Colonel, ebbry body's gone!" while the elevator boy grins as you go down to meet your admiring friends—of the other class.

As yet the jokes have not been carried this far, but as every class endeavors to surpass its predecessors, according to the laws of geometrical progression it will not take many seasons to reach this moderate goal.

It should be remembered that if this matter be carried to an extreme we are not only inconveniencing each other, which really matters little, but also the friends of the Institute, whom we are expected to meet. The sum and substance of it all being that the receptions are given for our pleasure and profit, and that we should endeavor to make them as enjoyable to all parties concerned as possible.

Let us then cease kidnapping each other, and secreting our enemy's best wearing apparel before we inaugurate a custom which is not appropriate to the occasion, to say the least.

* * *

SINCE the praiseworthy attempt of '93 to begin a sinking fund for a gymnasium (which attempt resulted in a fund true to its name in every bad sense of the word), nothing until the present time has been done to provide the athletes of Rose with more suitable quarters.

The present athletic directors, however, have decided to make another attempt to create such a fund, and we hope they may be successful or at least will continue with the good work until the requisite amount of money be accumulated.

The proposed gymnasium is a plain substantial edifice and will be placed where the coal sheds and stables are now located while the latter will be removed to a more retired position behind the shops.

With such a gymnasium and the running track, which will be constructed as soon as the weather permits, Rose will be fairly well equipped for athletic training. It is safe to say that the present gymnasium is of no use to us whatever, and were it not for the city Y.M.C.A. our men would get completely out of training during the winter months.

The alumni are expected to give substantial encouragement to this enterprise, and since they have been seldom called upon to aid their Alma Mater, we trust they will evidence the patriotism which every son of Rose should possess.

* * *

LAST year the lack of interest in school organizations called forth from the editor of THE TECHNIC a lecture in that respect and one which we undoubtedly deserved. But since the interest in all branches of our social organizations has been revived with an astonishing rapidity we cannot, in justice to the school, fail to call the attention of our friends and alumni to the fact. The only club which did exist, according to tradition, but has not yet been revived, is the cycle club, and doubtless if old Boreas had not been so lavish in keeping us supplied with snow the thoughts of our wheelmen would have been turned in that direction.

A Glee Club has been in existence for some time, a Camera Club, Mandolin Club and Telegraph Association have all been recently organized. The Orchestral Club, which for some time was in danger of disbanding, owing to the lack of a leader and sufficient first violins, has now resumed its work upon the acquisition of new members and will give its annual concert.

Such enterprise among the students is indeed laudable, for every organization which is not a class affair, causes the intercourse between the classes and consequently that unity of interests so necessary in a college which is numerically small.

The interest in such organizations may of course be detrimental to a man's studies but more often does it keep him from mischief. This awakening at least shows that the students of Rose are fully alive and possess a superabundance of energy which, if cultivated, will show its good fruit in their work after passing from college as well as while within its walls.

* * *

OUR alumni articles are not materializing very rapidly and we request that those who intend to, contribute in the very near future.

LITERARY FAME.

BY INSTRUCTOR R. R. C. SIMON.

Bacon, in that beautiful fragment on fame, which, however, he has left us but half told, after remarking that the poets had described fame as a monster of many voices, many eyes, many ears and many feathers, says in that grand style of his abounding in metaphors, which however he himself so much condemns, "but now if a man can tame this monster, and bring her to feed at the hand, and govern her, and with her fly other ravening fowl, and kill them, it is somewhat worth."

The truth of these words can hardly be questioned. For what an eternal striving and longing there is in the hearts of most men after fame. And yet how comparatively few there are who win for themselves a lasting fame or reputation. For fame, like all other things which are supposed to give or at least to increase our happiness, is dispensed with the same equality of distribution. He that is loudly praised to-day, will be clamorously censured to-morrow; the writer who rises hastily into fame is in danger of sinking as suddenly into oblivion. Of the many writers who have filled their age with awe and wonder, and whose names we find celebrated in the books of their contemporaries, how comparatively few there are, whose names are now but so much as known and whose works are no longer to be seen, except perchance stored away in some collection or amid the lumber of libraries, where they lie but to show the deceitfulness of hope and the uncertainty of honor.

To what cause or causes may we assign this comparatively short duration of fame, this sudden decline of reputation? One of the chief of these, I think, is that they never were deserved and were at first but conferred on the writer, not by the suffrage of honest criticism, but by the fondness of friendship or servility, and often flattery. We find the great and the wealthy freely applauded in these times, but whose only claim to notice is that their names are for the time being on the lips of many mouths. Some of these have perhaps delighted their readers with allusions and remarks, in which all then were interested, and have so secured their attention. But the effect must cease with the cause. The times change. The many vicissitudes of life bring new hopes and new fears, new ambitions, new ideas. The love and hatred of the general public are alike transferred to other agents, and the writer whose works are no longer assisted by gratitude or resentment is left to the cold regard of idle curiosity.

The writer who wishes to secure a lasting literary fame, a broad literary reputation that will outlast his short earthly career, must reject the temptation to indulge the public with what he knows it wants, but must write on general principles, must deliver universal truths, such as will be equally useful at all times and in every country. He can, however, not expect his writing to be received with eagernsss by the general public, for it to spread with rapidity, because desire can have no particular stimulation, and that which is to be loved long must be loved with reason rather than with passion.

What the young writer of wholesome ambition should pray for is, not to flash like a meteor on the astonished world of fashion, but by solid and admirable writing slowly to win a place which has a wide and firm basis. Should his ambition, however, carry him no farther than to secure a transient fame or monetary success, these being the chief incentives to literary exertion with most of the writers of our day, he will devote his labors to temporary subjects, which easily find readers for him, but will as quickly lose them again; for there is nothing in their writings to make them valuable when the subject is no more. How many books there are, which but a few years ago seemed bright and witty, and however much embellished with sentiment and diversified with allusions, are to us now without interest and with-

out meaning. The wit of the writers has been lavished upon fugitive topics and as such they have passed away with their day.

The question has often been put, how is a lite-literary reputation formed? But the answer is still a secret. The reply might be given, by thinking nothing at all about reputation, but writing earnestly and carefully on the subjects and in the style most congenial to your habit of mind; but this answer would be somewhat too obvious, and leads us to no further results. On the other hand, you will ask, why is it that there are writers of no merit at all, who sell their books in thousands, while a man of real genius can but sell his by scores? It is claimed by some that one of the greatest securities for permanent fame is to mingle the bright with the darker tints, to combine, as Lord Macaulay said of Bacon, "so much glory with so much shame." Both Byron and Bacon may be said to have secured their fame partly by mingling the darker shades of evil with their greater qualities. Burns probably also owes a portion of his fame to his worst qualities. And so I might cite many others to verify the truth of this assertion.

A recent writer has said, in an article on Carlyle, that "it is a rare honor for any writer—at least for one who is neither poet nor novelist—to have his productions live beyond two generations and to continue to be a literary force, when fifty years have altered all the conditions in which he wrote and the purposes and ideas which he treated." Now if this be true of such a writer as Carlyle, what hope can the mediocre writer entertain of securing for himself a lasting fame or reputation. The modern school of Scientific Historians has even declared that Carlyle's "History" is but a splendid failure, and that he was more of a declaimer than a thinker. Verily, we may exclaim as Byron did:

"What is the end of fame? 'tis but to fill
A certain portion of uncertain paper.
Some liken it to climbing up a hill,
Whose summit, like all hills, is lost in vapor.
For this men write, speak, preach, and heroes kill,
And bards burn what they call their "midnight taper."
To have, when the original is dust,
A name, a wretched picture, and worse bust."

But let this not deter the young and aspiring writer to venture forth in quest of literary fame. But to a few in a generation is given the gift of real originality; yet those who are the medium of communicating unto thousands the truths which would otherwise be out of their reach, are rendering a substantial service to mankind, and a service which will receive its due reward of gratitude. Charles Nodjer, the French writer, very modestly said, "Presque tout ce que j'ai à dire a été dit ailleurs, a été dit autrement, a été dit mieux." Let each one do his work as well as he can, and it will be sure to bear good fruit, whether he be censured or praised. Shelley remarked with reference to the failure of authors to secure, by harsh and unkind criticism, the praise and reputation they would otherwise be entitled to, "Whatever talents a person may possess to amuse others, be they ever so inconsiderable, he is yet bound to exert them. If the attempt be ineffectual, let the punishment of an unaccomplished purpose have been sufficient; let none trouble themselves to heap the dust of oblivion upon his efforts."

On the other hand, let this not be looked upon as an incentive for every and anyone to write a book as being the shortest cut to reputation and fame. And it will not be out of place here to say a word or two with reference to those, who by compilations, seek to gain recognition for themselves. A noticeable peculiarity of the present time is the marvelous multiplication of books. Every day we see numbers of new advertisements of literary undertakings. And yet how few there are of all these that can lay any claim either to pleasing or instructing. It would seem that the majority of these writers have often no other task than to lay two books before them and from these to compile a third, adding very little, if any, new materials of their own and often very little application of judgment to those which the former authors have supplied. But all compilers should not be discouraged, or let it not be understood that all compilations are useless. Particles of science are often very widely scattered through a book and writers

of extensive comprehension have incidental remarks upon topics very remote from the principal subject, which are often more valuable than formal treatises, and which yet are not known because they are not promised in the title. Now the writer that collects those under proper heads does a most praiseworthy work, for although he exerts no great abilities and shows no originality of his own, he at least facilitates the progress of others, by making more easy of attainment that which is already written.

But how many of the collections pouring daily from the press are made at little expense of time or inquiry and but serve to distract choice without supplying any real want. However should we exact of every man who writes, that he should say something new, would be to reduce authors to a small number; to oblige the most fertile genius to say only that which is new, would be to contract his volumes to a few pages.

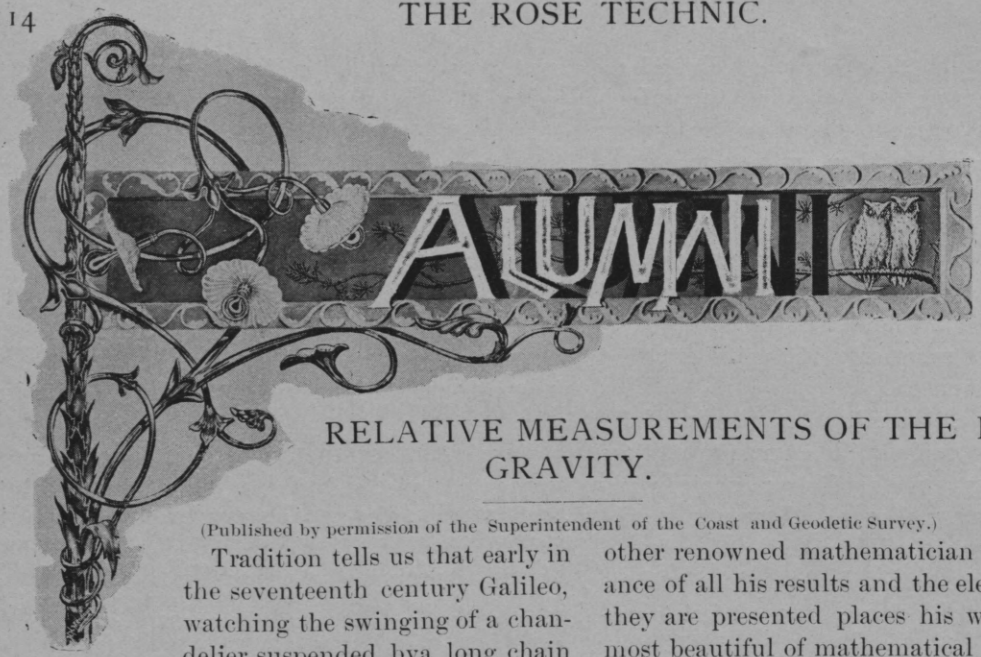
The authors in any nation whose fame lasts from age to age are very few; for there are very few that have any other claim to notice than that they catch hold on present curiosity, and gratify some accidental desire, or produce some temporary convenience. And however writers may long for fame and seek to arrive at eminent heights of reputation, they should take care to inform themselves before they attempt to inform others.

Joseph Wolcott, the English writer and painter, seems to have had a marvellous insight into human nature, when he quoted the following lines whilst addressing the Royal Academicians in London, and with which I will now close.

"What rage for fame attends both great and small!
Better be d——d than mentioned not at all."

Once a Freshman was wrecked on an African coast,
Where a cannibal monarch held sway.
And they served up that Freshman in slices on toast,
On the eve of that very same day.

But the vengeance of Heaven followed swift on the act
And before the next morning was seen,
By the cholera morbus that tribe was attacked,
For the Freshman was dreadfully green.—*Ex.*



RELATIVE MEASUREMENTS OF THE FORCE OF GRAVITY.

(Published by permission of the Superintendent of the Coast and Geodetic Survey.)

Tradition tells us that early in the seventeenth century Galileo, watching the swinging of a chandelier suspended bya long chain in a church at Florence, first conceived the idea of isochronism, the property by which a pendulum oscillates in different arcs in nearly the same time. He also suggested that this principle might be used for time keeping purposes, but to a Dutch philosopher, Huygens, apparently belongs the honor of the first application of the pendulum to clocks near the middle of that century, and the first development of its mathematical theory. A few years later, in 1672, Richer, a French astronomer, found that at Cayenne, near the equator in South America, a pendulum adjusted to beat seconds at Paris, would lose about two minutes a day, proving the former place to be further from the earth's center than Paris. Thus was furnished the first experimental proof of the flattening of the earth at the poles, and of the variations of gravity on the earth's surface, and the discovery was the more creditable because it was not accidental as commonly related. One object of Richer's work was to compare the length of a seconds pendulum at the two places. In 1743 Clairaut published his celebrated theorem establishing a relation between the difference of gravity at equator and poles and the ellipticity of the earth on a certain assumption as to its constitution, one of those great demonstrations which won for him the praise from another renowned mathematician that "the importance of all his results and the elegance with which they are presented places his work amongst the most beautiful of mathematical productions." A few years ago a committee of the French Academy of Sciences reporting on some results presented by an American, an officer of the Coast and Geodetic Survey, made this assertion: "One of the most interesting conquests of science is certainly that which has shown us that on causing to oscillate near the pole and the equator a weight suspended by a thread of known length, we are able to deduce the figure of the terrestrial globe."

The intimate relation that was thus early shown to exist between the force of gravity and geodetic problems of the higher order led at the close of the last century and the early part of the present to considerable interest being taken in pendulum observations. A number of expeditions were sent out by European governments for this special purpose, some circumnavigating the earth; but with the slow and expensive methods then used but a comparatively small number of points could be determined. Stimulated by the development of more portable instruments and simpler methods, there has been a considerable revival of interest in this subject in recent years, and there is now scarcely a country that has prosecuted geodetic or other surveys of precision, but what has paid more or less attention to gravity measurements.

Clairaut's law is expressed by the equation

$\frac{g_p - g_e}{g_e} = \frac{5}{2}m - e$ where g_p is gravity at the pole, g_e is gravity at the equator, m is ratio of centrifugal force to gravity at the equator, and e is the ellipticity of the earth, or the ratio of the difference of the axes to the major axis. This formula cannot be used directly on account of the impracticability of measuring the force of gravity at the poles. The following relation has been established however, permitting the combination of observations made at any latitude, from which to derive gravity at poles and equator, and by substitution in the above formula, the flattening of the earth.

$$g \text{ (at latitude } \phi) = g_e + (g_p - g_e)\sin^2\phi$$

At various times as additional data has accumulated geodesists have combined the results of all available gravity measurements, and deduced therefrom values for the amount of flattening of the earth. The two most notable computations of this sort made in recent years are those of Clarke, who obtained the value $\frac{1}{293}$ and Helmert, whose result is $\frac{1}{299}$. It is an interesting fact that these values closely approach respectively the two most important results, those of Clarke and Bessel, derived by an entirely independent method, that is comparing the lengths of arcs measured by triangulation on different parts of the earth's surface.

Notwithstanding many efforts no other instrument than the pendulum has as yet been found to measure gravity with the required precision, although some device that would give a direct measure, such as a spring balance, for example, would be far more convenient.

In the earliest experiments an attempt was made to approximate the theoretical simple pendulum, which may be defined as a body having its mass concentrated in a single point and oscillating about another point from which it is suspended by a weightless fibre; it is to the simple pendulum that the familiar law $t = \pi\sqrt{\frac{l}{g}}$ applies. Any other pendulum is called compound, under which head, of course, come all that are possible in practice. The so-called ball and wire pendulum, such as the famous one used by Borda, is the nearest approach to the simple. Although considerably employed in early days, and perhaps well adapted to the purpose of measuring the absolute force of gravity, such apparatus really belongs to the laboratory, not being suitable for transportation. The pendulums most used in recent years are rigid bars of metal of various forms and come under two general heads, "reversible" and "invariable." The former is provided with two knife edges, with center of gravity between but nearer one of them, and may be used for measuring the absolute force of gravity, as the length of the equivalent simple pendulum can be deduced if the distance between the knife edges and the relative position of the center of gravity are known. The invariable pendulum has but a single knife edge, and as it is practically impossible to measure its length with precision, it is only adapted to relative gravity observations, but for this purpose it is very convenient. It is called invariable because the theory of its use requires that it shall not be changed or injured during a series of observations, except such alterations of length as are due to temperature and which can be allowed for. Its length being supposed constant, the period will vary inversely as the square root of the force of gravity; so that if its time of oscillation is determined first at a base station and then at any other desired points the relation of gravity at each of these points to that at the primary station may readily be deduced from the equation $\frac{t_1}{t_2} = \frac{\sqrt{g_2}}{\sqrt{g_1}}$. Finally, the constancy of period is tested by determining its period again at the starting point.

Nearly all the older styles of pendulum, whether reversible or invariable, were about a metre in length, and the apparatus was very cumbersome, particularly when it was desired to use an air-tight case. About thirteen years ago Von Sterneck introduced in Austria a shorter, or half-second pendulum, and also devised an ingenious method for observing coincidences between a pendulum and chronometer. Dr. Mendenhall made important changes in this style of apparatus, improving it in a number of ways, and the following is a brief de-

scription of it as now used on the Coast and Geodetic Survey: A set consists of three pendulums, each about a quarter of a metre in length, carrying an agate plane in the head and arranged to swing on an agate knife edge; each is swung alternately in an air-tight case from which about nine-tenths of the air is exhausted with a small air pump. This case is provided with windows for observing, leveling screws, and devices for starting and stopping the pendulum and reading the arc of oscillation, the perfection of the mechanical detail being due to Mr. Fischer, chief mechanician of the survey. Each pendulum carries small mirrors, near which is a fixed mirror in the case. A break circuit chronometer, by means of an electromagnet, moves a shutter at the end of each second, which throws a flash of light upon the two mirrors through a slit.

In an observing telescope the two bright images of the slit as reflected by the two mirrors are seen at the end of each second. As the pendulum is purposely made so that it is a little slower than a chronometer, making a double oscillation in slightly more than a second, the relative position of the two images will change, and once every five or six minutes the images will cross, this being the moment of coincidence. It is evident that between two such coincidences the pendulum will have made one less oscillation than twice the number of seconds, so that the period may be readily derived from the relation $t = \frac{s}{2s-1}$. In practice swings of about eight hours length are made, following in succession to cover an interval of forty-eight hours, or longer in case of inability to obtain time observations. It is usually necessary to observe only the first and last three coincidences of a swing, as from these the total number of coincidesces that have occurred may be deduced. The pendulums are entirely free except for the first impulse that sets them in motion. With the adopted air pressure of 60 mm. the total arc of oscillation will fall off in eight hours from 55′ to 20′. To make the observations at different stations comparable it is necessary to allow for all changes of conditions which may affect the period of the pendulum, though the endeavor is of course made to keep nearly uniform such conditions as are controllable, as air pressure and arc. Five corrections must be applied to the observed periods, namely for arc, temperature, pressure, flexure, and rate of chronometer. The reduction to infinitely small arc depends on the ordinary theoretical formula. The effect upon the period of variations of temperature, air pressure and flexibility of support have been investigated experimentally and coefficients deduced. The flexure is obtained by measuring the movement of the support when a known force is applied horizontally in the plane of oscillation. The rate of the chronometer is found by star observations for time made each evening with a portable astronomical transit set in the meridian. For this purpose also are carried a light observatory tent and a chronograph.

During the past season the first extensive series of gravity measurements in the United States has been carried out with the above apparatus, by the writer assisted at different times by Mr. C. E. Mendenhall and Mr. S. B. Tinsley. This work as planned by Dr. T. C. Mendenhall comprised twenty-six stations, eighteen of which form a transcontinental line extending westward to Utah in the neighborhood of the 39th parallel of north latitude. The wide variety of topographic features traversed render this series valuable in connection with the questions of the continental distribution of gravity, the proper method of reduction to sea level, and in problems of the highest importance in terrestrial physics and geology. The pendulums were swung at Washington several times early in the season, and again, at its close for the purpose of testing their invariability as well as the method of observation, with extremely satisfactory results. The following are the average periods of the three pendulums from five independent determinations:—

Apr. 25—Apr. 27,	1894,	0.5007123 second.
May 10—May 12,	"	7124 "
May 31—June 2,	"	7124 "
June 23—June 25,	"	7124 "
Oct. 31—Nov. 2,	"	7121 "

The average time required for a station including traveling was slightly over five days. As a comparison with older methods it may be stated that the famous series of pendulum observations carried out in India in connection with the Great Trigonometrical Survey required six years of field work for its completion, although it but slightly exceeded this season's work in number of stations. This is partially due, however, to the difference in transportation facilities.

The table gives a summary of the results of the past season. These are based on the provisional value adopted for Washington (C. and G. S. office) g=980.098 dynes (or centimetres in terms of acceleration). There are considerable discrepancies in absolute measures of gravity, 30 determinations

earth. The first term allows for elevation simply, and the second term for the attraction of the matter lying between sea level and station on the supposition that the latter is on a horizontal plain. Where the country is rough a small correction must be made to allow for surface irregularities. In late years it has been advocated by several that the second or attraction term in the above formula should be omitted and the correction made for elevation only. This is on the theory that the surface of the earth is in general in a condition of hydrostatic equilibrium, and that therefore any elevation above sea level must be compensated by a lesser density below; if the earth were conceived to be made up of cones having their apexes at the center and cutting out equal areas at the sea level,

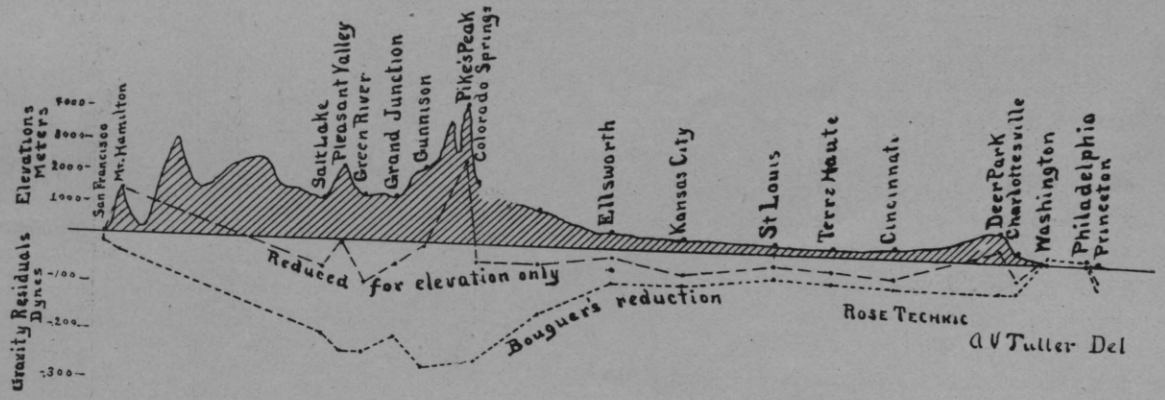


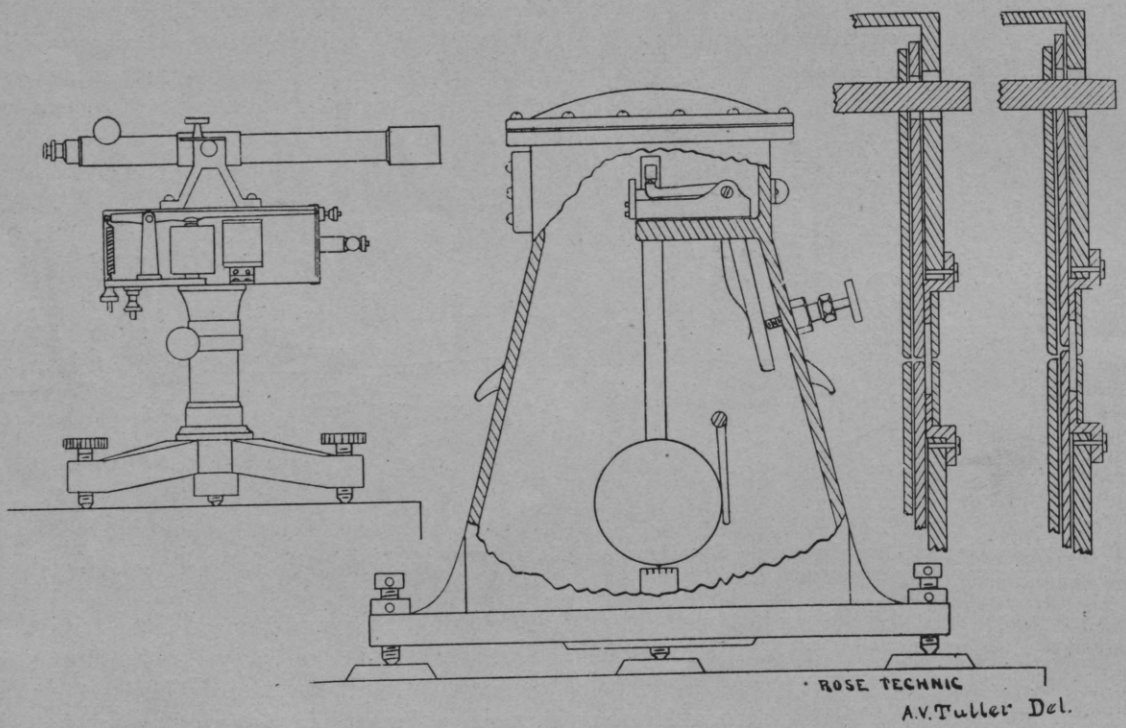
Diagram showing relative elevations of stations and differences observed, minus computed gravity, for two methods of reduction to sea level.

made in various parts of the world giving values, when referred to Washington, ranging from 980.047 to 980.285. An accurate knowledge of absolute gravity is not necessary, however, in geodetic applications of relative results. The proper reduction of pendulum observations to the sea level is a very important matter which has led to much discussion, as on it depends their utilization for the computation of the figure of the earth and other purposes. Bouguer's formula, which has generally been used for this purpose, is $dg = g\frac{2h}{r}\left(1 - \frac{3}{4}\frac{d}{\triangle}\right)$ where dg is the correction to observed gravity, H is elevation above sea level, r is radius of earth, d is surface density, and $\triangle$ is mean density of the

there would be the same mass of matter in each. This idea may be familiarly illustrated by a large iceberg floating in the ocean. The excess of matter above the sea level is exactly compensated by the fact that the ice below has a less density than sea water, so that the mass in a cone having its base in the iceberg is the same as it would be if the ice were removed; and if gravity were measured on top of the berg the attraction of the ice above sea level would be compensated by the lesser density below.

In the table the reduction to sea level is given by both methods, using in Bouguer's formula 2.56 an average value for d, except in two cases where the surface density had been definitely deter-

mined. Mr. Gilbert of the Geological Survey is now making a study of the most probable values of d for these stations. The reduced values are compared with g computed by a theoretical formula $g=978.066\ (1+.005243\ \sin^2 \Phi)$, based on Clairaut's theorem, Clarke's figure of the earth, and the assumption that gravity is normal on the Atlantic Coast, and the differences, observed minus computed gravity are given in the table, as well as in the diagram for those stations near the 39th parallel, together with the relative elevations, all plotted to scale from the horizontal line considered as representing sea level and normal gravity. Two formerly determined stations on the Pacific Coast are included in this diagram to render it more complete. With Bouguer's reduction (dotted line) it is seen that there is apparently a very considerable defect of gravity under the western plateau, sufficient for instance to affect a seconds pendulum at Gunnison by eleven oscillations a day. This probably means that there is a considerable lack of density in the matter below sea level under this region. It cannot be accounted for to any considerable degree by a supposed abnormal condition of the mass above sea level, as it is easily seen that to make up for all of this discrepency would require the absurd supposition that all the matter above sea level has a density slightly less than nothing. If we entirely omit the effect of the attraction of the mass above sea level we see (dashed line) that the apparent defect largely disappears, though the line becomes very irregular in mountainous districts, due probably to lack of perfect compensation on account of the rigidity of the earth's crust for limited areas. It follows closely the line of elevations, gravity being apparently too large at stations above the average level of the country and too small at those below, as was to be expected. Very marked is this in the case of Pike's Peak; here the attraction of the mountain mass itself would account for most of the rise in the line. It is a most interesting fact in this connection that oceanic islands on the other hand have invari-



Side elevation of receiver and flash apparatus and section through shutters.

ably shown with Bouguer's reduction a considerable excess of gravity above the normal, and by amounts nearly equal to the attraction of the islands themselves considered as displacing sea water. These points are merely touched on here to indicate the interesting nature of the problems that await solution by means of the pendulum.

As recently wrote a very distinguished German geodesist, "pendulum measurements will be a most important means of help not only to geodesy but also to geology. A wide extension of pendulum observations is in the highest measure to be desired for both sciences."

stations is due to the difference in distance from the earth's center, and to the vertical attraction of the mountain as compared with the attraction of the earth. The attraction of the mountain was carefully calculated by dividing it into zones and compartments on a contour map, and computing the effect of each, using a value for the density of the mountain (2.64) obtained by weighings of specimens by Mr. Cross of the Geological Survey. From these data the mean density of the earth was computed to be 5.68.

A set of much smaller pendulums, designed by Dr. Mendenhall, was also tested at four of the

SUMMARY OF RESULTS OF MEASUREMENTS OF GRAVITY, WITH REDUCTION TO SEA LEVEL AND COMPARISON WITH THEORETICAL FORMULA.

Stations.	Latitude. North.	Longitude. West.	Elevation.	g Observed.	g Reduced to Sea Level. By Bouguer's Formula.	g Reduced to Sea Level. By Correction for Elevation Only.	g Computed.	Differences Observed—Computed. Corrected by Bouguer's Formula.	Differences Observed—Computed. Corrected for Elevation Only.
	° ′	° ′	metres	dynes	dynes	dynes	dynes		
Boston, Mass	42 22	71 04	22	980.382	980.387	980.389	980.394	—.007	—.005
Cambridge, Mass	42 23	71 08	14	980.384	980.387	980.388	980.396	—.009	—.008
Princeton, N. J	40 21	74 39	64	980.164	980.177	980.184	980.216	—.039	—.032
Philadelphia, Penn	39 57	75 12	16	980.182	980.185	980.187	980.181	+.004	+.006
Ithaca, N. Y	42 27	76 29	247	980.286	980.337	980.362	980.402	—.065	—.040
Washington, D. C. (C. & G. S.)	38 53	77 01	14	[980.098]	980.101	980.102	980.087	+.014	+.015
Charlottesville, Va	38 02	78 30	166	979.924	979.958	979.975	980.013	—.055	—.038
Deer Park, Md	39 25	79 20	770	979.921	980.076	980.158	980.134	—.058	+.024
Cleveland, Ohio	41 30	81 37	210	980.227	980.270	980.292	980.318	—.048	—.026
Cincinnati, Ohio	39 08	84 25	245	979.990	980.040	980.065	980.109	—.069	—.044
Terre Haute, Ind	39 29	87 24	151	980.058	980.088	980.104	980.139	—.051	—.035
Chicago, Ill	41 47	87 36	182	980.264	980.301	980.320	980.343	—.042	—.023
St. Louis, Mo	38 38	90 12	154	979.987	980.018	980.034	980.065	—.047	—.031
Kansas City, Mo	39 06	94 35	278	979.976	980.033	980.062	980.105	—.072	—.043
Ellsworth, Kan	38 44	98 14	469	979.912	980.006	980.056	980.073	—.067	—.017
Wallace, Kan	38 55	101 35	1005	979.741	979.943	980.050	980.089	—.146	—.039
Colorado Springs, Col	38 51	104 49	1841	979.476	979.844	980.042	980.083	—.239	—.041
Denver, Col	39 41	104 57	1638	979.595	979.926	980.099	980.156	—.230	—.057
Pike's Peak, Col	38 50	105 02	4293	978.940	979.840	980.261	980.083	—.243	+.178
Gunnison, Col	38 33	106 56	2340	979.328	979.802	980.048	980.057	—.255	—.009
Grand Junction, Col	39 04	108 34	1398	979.619	979.903	980.049	980.103	—.200	—.054
Green River, Utah	38 59	110 10	1243	979.622	979.874	980.005	980.096	—.222	—.091
Grand Canyon, Wyo	44 43	110 30	2386	979.885	980.368	980.619	980.605	—.237	+.014
Norris Basin, Wyo	44 44	110 42	2276	979.936	980.395	980.636	980.606	—.211	+.030
Lower Basin, Wyo	44 33	110 48	2200	979.918	980.363	980.595	980.590	—.227	+.005
Pleasant Valley, Utah	39 51	111 01	2191	979.498	979.941	980.172	980.171	—.230	+.001
Salt Lake City, Utah	40 46	111 54	1322	979 789	980.060	980.196	980.253	—.193	—.057

The observations on the summit of Pike's Peak and near the base at Colorado Springs afford a means of computing the mean density of the earth, as the difference in gravity at the two

stations. These are in general principles like those described, but have a period of about quarter of a second, and are the smallest ever used for this purpose. They gave satisfactory results, as will be

seen from the following comparison with the half-second pendulum determinations:

	½ SECOND PEND.	¼ SECOND PEND.	½ S.—¼ S.
Chicago	980.264	980.249	+.015
Washington	980.098	980.098	.000
Denver	979.595	979.593	+.002
Pike's Peak	978.940	978.945	—.005

In closing, it may be of interest to illustrate in simple terms the amount of the range of the force of gravity on the earth's surface. A pendulum adjusted to beat seconds at the equator would gain about 230 seconds a day at the poles; adjusted to beat seconds at the sea level it would lose about 50 seconds a day at the summit of Pike's Peak in the same latitude. If we made our weighings with a spring balance, a ton at the equator would gain about 11 pounds at the poles; a ton at the sea level would lose 2 pounds at the summit of Pike's Peak. What is spoken of as the force of gravity, designated by the letter g, is the resultant of the attraction of the earth and the vertical component of the centrifugal force, the latter varying from $\frac{1}{289}$ part of the earth's attraction at the equator to zero at the poles. If the rotation of the earth should cease, a pendulum that had previously been adjusted to beat seconds at the equator would gain 149 seconds a day there, but at the poles there would be no change.

NOTE The scale of gravity residuals is given in the diagram only for negative differences, observed g— computed g. The same scale is to be understood as extending above the base line for positive value.

G. R. PUTNAM.

SPONTANEOUS COMBUSTION AND WEATHER WASTE OF COAL.

Coal is a very complex substance, and though one with which we have long been familiar, and which we make use of by oxidizing (burning), the subject of the exact conditions under which its oxidation takes place has received but little attention, and is, even yet, but imperfectly understood. We all know that at a high, but variable temperature, the carbon of the coal combines with the oxygen of the air and forms carbonic oxide or carbonic acid as the case may be; but there are few who know at what temperature this absorption of oxygen commences, or what conditions facilitate it at low temperatures. At the ordinary temperature coal absorbs oxygen from the atmospheric air. At a temperature not exceeding 527° Fahr. it may also absorb hydrogen. On the other hand, coals, when freshly mined, give off a very noticeable amount of a hydro-caobon gas. This discharge of gas continues for a considerable time, probably several weeks in some cases, after the coal is mined. In proof of this we have the record of a great number of explosions on vessels loaded with coal, and even with anthracite, days and sometimef weeks after it was mined.

It has also been ascertained that all coal, or at least all bituminous, and above all those soft varieties that are ricq in volatile matter and poor in carbon, lose a large part of their volatile matter by exposure to the action of the atmosphere, especially when the coal is in a finely divided state, and is exposed to a high temperature and moisture. The gas thus evolved varies, both in quantity and composition, according to the nature of the different coals; it contains carbonic acid, oxygen, nitrogen, marsh gas, ethel hydride (C_2H_6), gases absorbable by sulphuric acid, and sometimes a small amount of carbonic oxide. Nitrogen being by far the most abundant of these gases.

That some coals are capable of spontaneous ignition when allowed to accumulate in the form of dust or slack, and sometimes when subjected to heavy pressure in the pillars of coal mines is a well known fact; but to what this property is due is an open question, though it has usually been attributed to the decomposition of iron pyrites in the coal and shale accompanying the coal. The atmospheric oxidation of iron pyrites, by which the sulphurets are changed into sulphates, is a comparatively slow process; and, though capable of developing a large amount of heat in a confined area, it does not account for the majority of instances of spontaneous ignition of coal, both in mines, on board ship and in stock yards. It has been shown conclusively that the coals most liable to spontaneous ignition are not those which contain the largest percentage of iron pyrites, but that this property is principally due to the at-

mospheric oxidation of the organic substance of the coal. Many varieties of coal deteriorate to a great extent when exposed to the air, and this deterioration is greatly favored by high temperature, and in coals which contain sulphurets of iron, by moisture; in coals free from iron pyrites this oxidation seems to be more energetic when dry than when wet. It is always greatly increased in all kinds of coal by increase of temperature, and is more energetic when the coal is in dust or slack. This deterioration of coal is known as "weather waste." It is not depending solely on the physical character of the coal, though the harder the less it is injured. In the case of coking and gas coals, however, the depreciation in the heating power, and in the coking and gas producing properties is very great; indeed, a very moderate exposure to the air in heapg at a high temperature and when moist (for these coals, for the most part, contain more or less pyrites) frequently entirely unfits them for use.

The spontaneous ignition of coal is, doubtless, greatly facilitated by, though not altogether due to, the presence of iron pyrites; for the oxidation of the pyrites is attended with a considerable development of heat, and by swelling it splits up the coal and renders it more pervious to the oxygen. The real cause of spontaneous ignition is probably the oxidation of the organic substance of the coal; it is, in fact, a very energetic example of weather waste, and the precautions to take in each case are the same. In mines the crushing of the pillars where they are left too small, and their gradual spalling off from the oxidation of the coal and pyrites in the coal cause an accumulation of fine coal around the pillars; this and the fine coal thrown back into the "gob" along with the shales (which contain most of the pyrites) and other rubbish, form exceedingly favorable conditions for spontaneous combustion. There is usuenough oxygen in the air of the goaves to support this slow combustion, while the velocity of the air current is not sufficient to carry off the heat, and thus prevent the weather waste from developing into the spontaneous ignition of the coal.

E. F. Robinson, '94.

Earlington, Kentucky, January 20th, '95.

NOTES.

J. Chas. Young, '92, has accepted a position in the drafting department of the Edison Illuminating Company, of St. Louis, where he will be assistant to W. H. Palmer, '87. He swells the R. P. I. contingent in St. Louis to five.

Mrs. Max. B. Fitch died at her home in Mattoon, Ill., January 18th. She will be remembered by the older alumni as Miss Mamie Wolf. Mr. Fitch, '90, has been located in Mattoon for the past two years as city engineer.

James Royse, '94, with Prof. Noyes, has a contribution in the February number of the *Journal of the American Chemical Society* on "The Volumetric Determination of Phosphorus in Steel and Cast Iron."

M. C. Andrews, '94, instructor in civil engineering, has found that he can not keep pace with the rest of the faculty of Rose without a wheel, and is now the happy possessor of a Victor safety.

Edw. F. Robinson, '94, has a position as mining engineer at Jellico, Tenn. He sends his love to Rose, and promises a gallon of moonshine to every visitor who supports the old rose and white.

A son was born to Professor and Mrs. O. P. Hood, '85, of Manhattan, Kansas, on January 20th. The child died January 29th, nine days after its birth.

Abe Balsley, '91, of Seymour, Ind., spent a few days in Terre Haute, recently, visiting Rose and in particular, his classmate, R. L. McCormick.

Edw. D. Frohman, '94, is intending to take a postgraduate course in chemistry at the Boston Technical School next year.

E. Brown, '94, is civil engineering in company with Harris, '91, for the benefit of Brown, Harris & Vigo county.

Sigmund Frank, '92, of Chicago, visited friends in Terre Haute recently. He paid Rose a call February 11th.

V. K. Hendricks, '89, of Logansport, was in Terre Haute a short time ago.

H. Kilbourne, '94, is at present hustling for a life insurance company.

H. S. Hart, '93, made a short visit to Rose recently.

THE NEW GYMNASIUM.

Is there a student in this Institute who has not felt a little mortified at our apartments in the basement when hearing men from other schools speak of their gymnasiums?

Is there a student in this institute who is not willing to contribute a small amount in order that in later years he can speak with pride of the R. P. I. gymnasium and her athletic team?

I think we can safely answer No to both these questions, and I am also confident that there is not a man who has ever worn the Old Rose and the White at a victorious field meet, who would not do all in his power to further the erection of a building which could aid so materially to our athletic victories.

The question of how a building could be obtained has been brought before the minds of both students and faculty more than once, but never before have any definite steps been taken toward its erection. With Dr. Mees' assistance, the athletic directors have devised a scheme which I will now explain, and which is sure to be a success if both alumni and students join hands and determine *that it shall be.*

We hope to have each student in the Institute contribute between two and five dollars, making a total of $300 say from the present members. Next we have about 130 alumni from whom we hope to raise between $800 and $1,000, and from outside sources we could probably get $500 more, making a total of $1,600. Our plans are to send letters to all the alumni, a copy of one of which will be found here and which will explain inself:

TERRE HAUTE, INDIANA, February 11th, 1895.

DEAR ALUMNUS:—Recognizing that since the foundation of this Institute we have been sorely in need of a gymnasium to keep up our reputation in athletics, and to turn out able bodied as well as able minded men, the students have at last determined, with the assistance of Dr. Mees, to take definite steps toward obtaining the much needed building.

Nearly every recognized institute in the United States is well equipped in this line, whereas our present allotment of a corner in the basement is not worthy of the name, gymnasium. In fact, our present apparatus is never used and never will be until we have a building suited to the purpose.

Our training in athletics is now entirely confined to the few fair weeks in spring, whereas with a gymnasium it could and would be kept up throughout the year, thus maintaining our present position upon the athletic field, and enabling us to float the Rose and White over many more victorious meets.

We propose to build a gymnasium on our campus which shall cost in the neighborhood of $2,000, a sketch, plan and description of which you will find on separate enclosed sheet.

Our alumni have never before been called upon to

help the students in any enterprise, but in this instance it is utterly impossible for us to do anything without their assistance, and we trust, as they have been here themselves and have felt this need of a gymnasium, they will help as much as lies within their power.

Our expectations are to begin the building one year from this spring, and would therefore be greatly obliged if you will fill out enclosed subscription blank for any amount which you think the cause justifies, to be paid on or before January 1st, 1896.

Each student attending the Institute will give all that he can, and this, together with what we hope to raise from the alumni and from other sources, should be sufficient to construct a building, at least.

Trusting we may hear from you at your earliest convenience, we are, Fraternally,

ROSE POLYTECHNIC GYMNASIUM COMMITTEE,
A. L. ROBINSON, Secretary.

There will also be an enclosed sheet, arranged by Mr. McMeans, containing a sketch and plans of the proposed building. As will be noticed in the letter, we only ask every man to say what he can contribute by January 1st, '96, and of course these amounts will not be called for until the athletic board sees its way clear to complete the building.

When this building is completed our intentions are to have regular organized classes and to employ an instructor to train the boys the year round, thus giving Polytechnics a chance (which they have never before enjoyed) of being on equal footing with students of other colleges.

And now before closing I wish to mention that the students of this institute have the reputation of never failing in anything which they undertake, and to succeed in this we must have the hearty co-operation of every student in the school. The matter rests almost entirely with you. Shall we have a gymnasium or not? I hope the sentiments of each and every one of us are:

Hurrah for the new gymnasium!
Hurrah for the Rose and White!
Hurrah for the boys that will train all year
And win everything in sight.

Hurrah for the new gymnasium!
We'll have one now at last,
And basement rooms with old brick floors
We'll bury with the past.

Hurrah for the new gymnasium,
To train our athletes in,
Just give us those subscription blanks,
And we'll come up with the tin.

A. L. ROBINSON,
President Athletic Association.

POLY Y. M. C. A. GYMNASIUM CLASS.

The Poly Gymnasium class, which was organized last month, is in a prosperous condition, the average attendance being at present about eighteen.

The class was organized for the special purpose of giving those athletes who intended taking part in the field day contests in the spring, a chance to train. For this reason the members will not be confined to the regular gymnasium work, but will receive special training along the lines that will be most beneficial to them in view of the work in prospect.

Moreover, any one desiring to train for some special event will be enabled to do so, and will receive all the attention and advice possible from Instructor Barnes.

There isn't any doubt that if the Institute possessed a gymnasium, properly fitted up, training for field day would begin long before the time it has done so heretofore, that is, with the advent of pleasant weather. Since we do not, at present, possess such an institution we are fortunate in being allowed the privilege of the advantages offered by the Y. M. C. A.

NOTES AND CLIPPINGS.

The annual meeting of the executive committee of the Indiana Inter-Collegiate Athletic Association has been called for March 9th, at the Denison House, Indianapolis. At this meeting arrangements will be made for the state field day, also the schedule will be arranged for base ball games among the several colleges and institutions of the state for the coming season.

The process of manufacturing a pitcher for the ball team has not been reduced to working condition as yet, the cold dark days having rather a discouraging effect on the candidates. However, the old gymnasium room in the basement has been arranged so that there is sufficient room for

throwing, and on bright days there is no difficulty whatever in seeing the balls. A manager for the team has not yet been selected, but this will in all probability be settled at the next meeting of the directors of the Athletic Association.

Ridgely, '96, captured the Swope gold medal at the last Indoor Pentathalon contest of the Y. M. C. A. These contests are held monthly, the winner at each one being privileged to wear the medal until the next contest. Arrangements are being made for an affair of more than usual interest to be held at the Armory some time in March, with the following order of events:

1. Rope Skip (200 times).
2. Putting 12 Pound Shot.
3. Pole Vault.
4. Quarter Mile Potato Race.
5. Running High Dive.

Several Poly athletes expect to enter and it is hoped the medal will still be retained in the Institute.

The commencement of work on the running track has been delayed by the continued bad weather, and prospects for an early start are not very encouraging. The track will be of very little practical benefit to the athletes this year, but will, we hope, be in prime condition for the spring of '96.

The Department of Fencing, which was introduced at Yale a year ago, has been discontinued owing to the lack of interest of the students in this form of athletics. The instructor who had charge of the department has returned to France.

Out of 1,112 football players in eighteen leading institutions only sixty-five were disabled for a week or more.—*The Buchtelite.*

"AN AWFUL BUTCHERY."

THE YALE–HARVARD GAME AS REPORTED IN GERMANY.

A member of the German Faculty of Yale has furnished a translation of an account in a German paper of the Yale–Harvard football game at Springfield. It is interesting as showing the ideas of American sports which are presented to the German public. The account comes from the *Muenchener Neuste Nachrichten*, under the head of "Brutal Sport."

"From New York the following is reported to the *Magdeburger Gazette:*

"The football tournament between the teams of Harvard and Yale in Springfield had terrible results. It turned into an awful butchery. Of twenty-two participants seven were so severely injured that they had to be carried from the field in a senseless condition. The vertebral column of one was put out of joint; a second one's nose was broken; a third lost an eye and a fourth broke his leg. The rest suffered severe internal injuries.

"The intention to injure each other in all their attacks was clearly evident. Therefore there can be no question of accident. Futhermore both teams appeared upon the field with a crowd of doctors, ambulances and attendants, which from the very start did not fail of producing a gruesome impression upon the spectators.

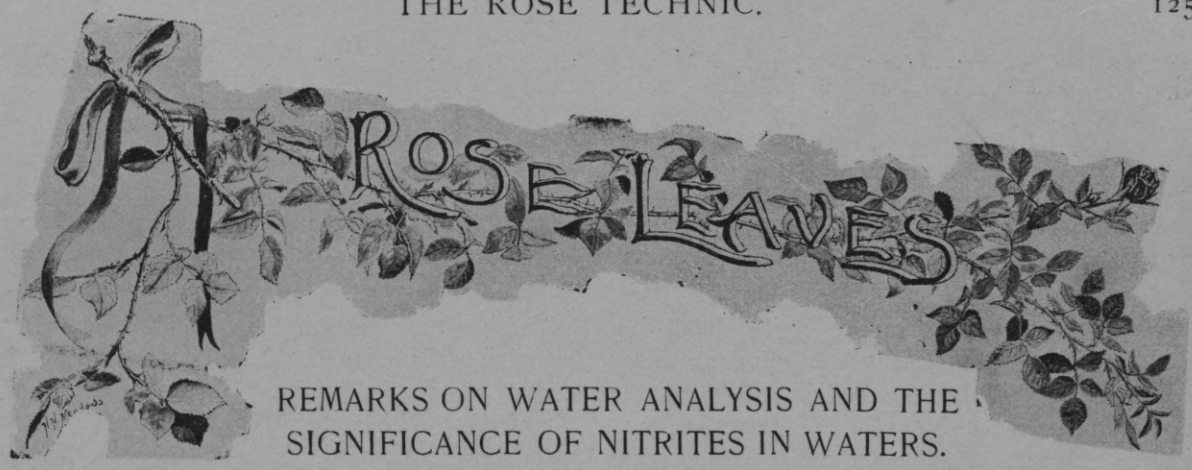
"Many ladies were present who fainted away at the awful cries of the injured players. The indignation felt towards the brutality of the students was powerful, but terror so dominated the spectators that nobody dared interfere.

"From other towns, too, incidents of brutality in football are reported. In Shreve (Ohio) and in Worcester (Mass.) they resulted in the death of a young man at each place.

"Many professors at the Universities are openly proclaiming in the newspapers their disgust at this disgraceful sport and protest against allowing its continuance. They are complaining a great deal about the behavior in general of a majority of the students. The study of sciences has become a side issue.

"The cult of all possible sports dominates all the colleges to such an extent that the parents of the students are in despair about the matter without being able to make any headway against the abuse."

Mr. Gruener, who furnished this translation, thinks he sees a political motive in this fiction, and is of the opinion that the papers printing such reports were misled by those who sought to thus influence the popular mind against the introduction of American and English athletic sports, which the Emperor favors.—*Harvard Crimson.*



REMARKS ON WATER ANALYSIS AND THE SIGNIFICANCE OF NITRITES IN WATERS.

The subject of water analysis is divided into two branches—technical and sanitary.

The technical has to do with the detection and estimation of all metals, acids, gases, etc, present; the estimation of which is similar to method used in any general analysis, with modifications necessary because of dilution and very small percents of some of the substances present.

The sanitary analysis has to do with the determination of ammonia, nitrites, nitrates, organic matter with its products of decomposition, the oxygen consuming power, hardness, presence of bacteria, etc.; and as the name implies, everything that affects the sanitary condition, or wholesomeness in case of potable waters.

The determination of free and albuminoid ammonias stand first in importance along with their connection with nitrites and nitrates, as they in a measure indicate the condition of water as to pollution, the nature of source of such pollution, and in what stage of decomposition it exists.

As to determination of ammonia, there is a distinction made between free ammonia, and albuminoid ammonia, which is ammonia existing in a combined form in the water.

If a water yields up its organic constituents slowly as albuminoid, it indicates *recent contamination with organic matter.* If it yields up rapidly it indicates that *old or decomposed organic matter is present.*

Total solids are determined by simply evaporating say one litre to dryness, dessicating and weighing. With foul water the residue contains carbon which often emanates fumes characteristic of certain vegetable or animal origin.

Water of the highest purity will be clear, colorless and nearly tasteless, although these qualities do not prove pure or wholesome water, as clear water may be saturated with nitrates or nitrites.

An unpleasant odor does not necessarily indicate the presence of injurious substances.

As to total solids, excessive proportions of mineral solids, especially of marked physiological action, are known to render water non-palatable, and sanitary authorities have fixed an arbitrary limit for total solids of 600 parts per million as safe, but artesian waters in constant use exceed that limit with no ill results.

Iron should not be present in amounts exceeding three parts per million.

Lead, copper, arsenic and zinc must be considered dangerous in any amount.

Common salt must be regarded with suspicion if not proven that it comes from infiltration through earth or from salt beds, since it is universally present in animal secretions, and may have come from such source.

Nitrates and nitrites in waters are of the very greatest importance. According to Frankland and others, nitrates are the organic skeletal remains of former existing nitrogenous organic matter. In themselves they are harmless, but they indicate that at some time the water containing them must have been contaminated with organic matter. The chief danger of organic matter in water is that it may contain the specific germs o

diseases. Animal impurities are far more dangerous than vegetable.

The production of nitrates from organic nitrogenous matter was an unexplained fact considered due to some obscure process of oxydation, until the observations of Schloesing and Muntz, in 1868. These gentlemen demonstrated it to be the action of a living ferment.

Impure waters, although frequently depositing a sediment charged with vital organisms, may, when settled, give a field as devoid of living forms as a pure spring water. But if sedimentation is less perfect, so that some of the particles of vegetable debris are left floating in the water, these particles will be seen microscopically to swarm with living organisms.

Water which seems perfectly free from putrefactive tendencies may be shown by Koch's process of of cultivation in peptonized meat jelly, to contain extraordinary quantities of bacteria. Some think that in a transformation of species there is danger in all these bacteria. Others hold that where there are many individuals—many species, there is increased likelihood of danger. Others again, believe after Koch's opinion, that some species exterminate others and that a large number decreases the liklihood of the existence of pathogenic species. Certain it is, that the majority of water bacteria are harmless, when we consider the immense number that is present in every glass of water we drink. On the whole, it appears that among the germs of natural waters pathogenic organisms, such as the bacilli, of typhoid fever, of cholera, etc., may be present, but outside of these the other organisms and water bacteria are beneficial rather than harmful, as they are engaged in an important work of oxydizing the impure and disease-burdened organic matter into more wholesome compounds. The sediment in the waters, and the soil especially, is the habitat of these organisms, hence the good results of purifying sewage and polluted waters by allowing it to pass over rocks, sand and soil, percolating and filtering, by which the organic matter is completely oxydized through action of these micro-organisms. Dr. Rauch, of the Illinois State Board of Health, states that the sewage of Chicago is so nearly destroyed in a canal flow of 33 miles to Joliet, that if same rate of purification be continued all pollution would be disposed of in a further flow of twelve miles.

The rate of purification is increased by presence of sand and stones and by water falls, where the aerification is more or less complete.

The amount of organic matter, silt, etc., contained in some river waters may be appreciated by referring to the sedimentation of water at St. Louis a few years ago for drinking purposes. Four settling basins with capacity of eighteen millions of gallons each were used. These basins were floated off each four months, and the annual sediment amounted to two hundred thousand cubic yards.

The anomaly of finding purer water in a cistern containing a foot of sediment in bottom than in one recently cleaned, is probably explained in that it means increased numbers of purifying bacteria.

The traces of nitrites and nitrates sometimes found in rain-water after a thunder storm are probably due to electrical action on nitrogen of the atmosphere, but the nitrates of water which has been in contact with the soil are formed from the ammonia or nitrogenous organic compounds which the water contained. This significance, however, can only be attached positively when we are sure there has been a constant supply of oxygen. Repeated experiments by Charles Smart, conducted on waters at intervals of ten days, showed the conversion of organic matter into ammonia, the gradual disappearance of this ammonia, with traces of nitrous and finally nitric acids being formed.

Since, then, nitrogenous organic matter in its progress to a stable compound passes through an ammoniacal and a nitrous stage, the presence of ammonia, nitrites and nitrates in a water, indicate a progressive degree of remoteness from the source of pollution. Ammonia and nitrites testify to the proximity of this pollution, especially if accompanied by a considerable portion of unaltered organic matter, and in such instance the nitrates present must be viewed as recently formed.

But if nitrates are unaccompanied by these transition products, (ammonia and nitrites), they

indicate an earlier formation, and can have no important bearing on the quality of water further than to increase total solids, for they may be present coming from geological formations. As nitrates are generally derived from recent organic matter, Frankland makes ammonia, nitrites and nitrates the basis of calculations of what he calls "sewage contamination." Tidy experimented on sewage by allowing it to run through troughs repeatedly, and found a decrease in the oxygen-consuming power as well as of organic nitrogen. After a few runs the offensive smell of sewage disappeared.

By comparison of a number of large cities in England, it appeared that the death rate in cities supplied with water from deep wells was greater than in those supplied from rivers.

Several factors enter into the purification of water in running streams, among which the oxydation and reduction through influence of bacteria present, sedimentation of particles by gravity carrying down objectionable organic matter, and precipitation by the mineral matter which is washed out of soil and taken up by streams in their flow, are active agencies. Admitting the germ theory of disease, and the presence of such specific germ cells floating in the streams, would they not, too, be soon destroyed—their envelopes bursting from osmotic pressure?

Now there are micro-organisms which produce the reduction of nitrates in absence of available oxygen, as well as those whose business it seems to be to form nitrates from nitrites by oxydation when available oxygen is present.

There are at least sixteen known different species of bacteria whose actions tend to oxydize from ammonia to nitrous and to nitric acid, and in like manner the denitrification seems to be performed by different species taking up the work from stage to stage, down through nitrous acid, nitric and nitrous oxide, to nitrogen.

The reduction of nitrates by organisms is only noticed in absence of free oxygen or of air, while for the building up, the presence of oxygen or air is necessary. Sterilization by heating or presence of antiseptics prevents the further action of these bacteria.

Alkalinity seems to prevent denitrification, as experiments by Warrington on solutions of ammonium carbonate tends to prove. This alkalinity does not destroy the nitrifying organism, but simply suspends its action. Now, in such solutions, the addition of gypssum furthers the action of the organisms and denitrification begins. Under certain conditions chlorates and bromates are in similar manner reduced to chlorides and bromides.

Warrington describes experiments where sand was moistened and a solution of sodium nitrate allowed to slowly percolate through it. After ten days only 21 per cent. of nitrate was present, the nitrogen of the other 79 per cent. having passed away in gaseous condition. In another experiment, one-tenth litre of urine containing one gramme of nitre per litre and one half gramme of soil was covered with paraffin oil, preventing access of air. In two days a slight evolution of gas commenced and nitrites were found distinctly present. The action ceased after a few days, and no further reduction of nitrates occurred, evidently because all available oxygen had been consumed.

Aerification is fatal to reduction, in fact produces the opposite effect of oxydation and building up to higher nitrogen compounds.

The significance of the presence of nitrites and nitrates is not certain unless the history of the water is somewhat known, as well as its constituents, source and other conditions such as presence of oxygen and temperature.

In first place, nitrous acid is easily decomposed by elevation of temperature, and certainly we can not say from the presence of nitrites whether they are reduction products of nitrates or have come from dangerous organic matter, unless we know as to the presence of oxygen, or of its presence at some time.

Dr. Frankland has emphasized that the occurrence of nitrates indicates that the water is undergoing or has undergone a natural purification, and

that the quantity of nitrates found represents the proportion of nitrogenous organic matter destroyed.

But it is true that in rainwater the nitrate is of atmospheric or inorganic origin, and also that in deep wells which generally contain a large amount of nitrate, this contamination must have been of geological origin.

Contrary to most deep well waters, our recent analysis of the Bronson artesian water of this city showed it to contain no nitrates but that it contained nitrites.

The absence of nitrates and presence of nitrites was thought probably due to the very large percent of hydrogen sulphide present (107.49 parts per million). Experiments on water free from nitrites, and to which was added nitrates and then treated under various conditions with hydroyen sulphide, showed the formation of nitrites. The reaction is probably first a reduction of mineral salts as for example, ferric to ferrous salts, then the ferrous salts in turn reduce nitrates present.

Warrington has noted this reduction of nitrates by oxides and some of the lower salts. The nitrates present at sometime in its history in this artesian water coming from a depth of 1800 feet are doubtless from geological origin and probably the temperature of the water aids in the reduction, the water issuing at temperature of 84° F.

Nitrates are also reduced by certain reducing metals.

The presence of ferrous iron and of nitrites in deep wells signifies very little, but in shallow wells and in streams it is highly probable that these waters have been very recently contaminated with sewage, for in the ordinary oxydation of sewage, (which contains much ammonia and no nitrates), its nitrogen is at once oxydized to the maximum at the expense of dissolved oxygen. In any case the presence of nitrites is suspicious, as it distinctly indicates a deficiency of oxygen, which is a bad feature, as it renders the water less able to oxydize any dangerous organic matter which at any time may enter.

The putrefaction of organic matter in presence of available oxygen is usually complete in about seven days as shown by free ammonia no longer increasing in amount. In fifteen days the ammonia has disappeared and nitrites have taken its place, reaching a maximum in twenty days, and if sufficient available oxygen be present, the nitrates are all oxydized into nitrates in about one month. Darkness is more favorable to this nitrifying action than light, as is found to be the case with the action of nearly all bacteria and microorganisms. In fact a strong light stops their action altogether.

Hence, as to nitrites the significance of their presence in water can only be attached with definiteness when some of the many conditions under which nitrites may be formed are known to have existed, and as with the many other features of water analysis great care must be exercised in making a proper interpretation of results.

W. E. Burk, '96.

SOPHOMORE RECEPTION.

The Sophmores were given a grand reception by the faculty at the Terre Haute House, Tuesday, February 5th. As is well known and appreciated the faculty had intended to give each class a reception at some time during the winter, with the object of enabling many of the students to become better acquainted with the people of Terre Haute, and as a slight diversion perhaps from the somewhat confining duties of study. In all respects the one given to the Sophs was a decided success. From the time of Dr. Mees' welcome until the final good night, each man was made to feel that he was among interested friends. The Ringgold Orchestra furnished music for the occasion. Refreshments were served toward the latter part of the evening.

A NEW USE FOR THE FORGE.

A Senior is responsible for the statement that on entering the blacksmith shop one morning during the cold spell, he saw three English sparrows sitting on the edge of the forge warming themselves near a bed of coals which had been left, but that they evidently had not learned how to turn on the blast, for the fire was low.

Last week Mr. Simm assigned to the Sophomores a piece of German prose to translate into their choicest English verse. The piece was decidedly sentimental in tone, and after it had been read each man felt that he had a delicate task on his hands, to do the subject justice. One man caught the fever from his first poetical effort, and attempted a bit of minstrelsy. He went to sleep over the arduous task and while thus delightfully engaged entertained a visitor unawares. To the visitor are we indebted for the following:

It was five hours before midnight. I was striving hard
with a collar
I had worn before, and a piece of chalk to make it white.
My task, ere long, was broken by a rap upon my chamber door.
'Tis that bore, I muttered; aye, 'tis he, calling again for
me to
Tell him how to work a problem in descriptive.
The fire was dying out, and I was cold; cold as an iceberg
Basking in the smiles of chaste Aurora in the Polar seas.
The curtains shook, and I shook too—'twas bitter cold.
I put more coal upon the fire, though coal is dear this
winter,
And said: "If that chump knocks again I'll sally out
and
Knock him down the stairs for scaring me." It may be
Some one else I mused, and then apologizing with a lie
as
White e'en as my face, I flung the door agape.
Night and his twin friend, darkness, alone looked in and
Stared me blind. I slammed the door. "It can not be
that I
Will be detained to-night," I thought. "That Freshman bold will
Come around and hold me till the reception has become a
Page in history." Another rap. My shaking limbs near
Shook the cobwebs from off my Webster's dictionary.
I gathered courage. No longer cold, but burning now
With rage, I opened wide the door. In, with a running
Hop step and jump, two Polys came, hatched last
September, and perched themselves upon a bust,
'Twas mine, and it was on the chamber floor.
Suffering then a sickly smile to split a countenance
wreathed
In mortal agony, I thus addressed the birds.
"Although thy heads be not crowned with the game
cock's
Ruddy plume, thou art not chicken hearted fowls indeed.
Present thy cards, for I fain would know thy names.
"Polly wants a cracker," they replied.
We must agree that never man before beheld a bird or
Beast, save one, upon a bust, and he would hardly
Call for crackers. 'Twas then I cried, "Release me,
pray.
Fly, fly away, and let me hasten to the reception."
The birds put two small dashes under what
They had said before. "I pray thee, Polys, let me go,"
I begged. "If not, alas!" Did I say a lass?
Ah! she. Picking from the floor a copy of
H. Rider Haggard's 'She,' I hurled it at their heads.
Unsteady aim. The fire received it and consumed it
Straight. One more attempt. "Art thou aware the
Head upon which thou'rt perched belongs unto a
Sophomore? Who knows all things, who—"
The author here goes to sleep.

MANDOLIN AND GUITAR CLUB.

Realizing at last that there was sufficient material in the Institute for a good mandolin and guitar club, a meeting was called last month of all interested and an organization effected. Sanborn, '96, was elected president, and Liggett, '96, secretary and treasurer.

The members present at the organization were: Walzer, '96, mandolin; Liggett, '96, mandolin; Snyder, '96, mandolin; Farrington, '96, mandolin; Kessler, '97, mandolin; Fletcher, 98, mandolin; Sanborn, '96, guitar; Connibal, '98, guitar; Hedges, '98, guitar; Spafford, '98, guitar; Speed, '95, banjo; Scott, '98, banjo. The first rehearsal was very satisfactory and gave promise of a successful future.

THE ORCHESTRA.

The Orchestral Club is now making active preparations for the annual concert, which it hopes to give the latter part of this term. It has secured an excellent leader in Mr. Colberg, and with the occasional assistanec of Dr. Mees, who will probably play the violin, the orchestra will be up to its old time excellence.

The membership at present is twenty, a little above the average. The rehearsals are held on Tuesday evenings and Saturday afternoons at Congregational Sunday school room.

WITH APOLOGIES.

Da wohnt ein Mann in unser Stadt,
Und dies Mann er heiss Mike
Er pickte auf ein feuer rot Eisen
Und legt es nieder sogleich.

TELEGRAPH ASSOCIATION.

At the last meeting of the Telegraph Association, a plan of organization presented by McMeans, '96, was adopted, and the Rose Polytechnic Telegraph Association was duly organized. The officers were elected as follows: O. E. McMeans, president; F. G. Hunt, secretary and treasurer; A. Meyers, superintendent.

All the arrangements, plan of route, etc., have been completed and the necessary supplies ordered. The main battery and a considerable portion of the wire belonging to the old company are still available so that there will be but little expense connected with the re-establishment of the line. The company will begin operations with fifteen instruments, and the line will extend from the Polytechnic building south as far as Chestnut and west as far as Sixth, which covers a greater part of the territory most densely populated with Polys. Time will be transmitted every hour from the automatic regulator in the laboratory, and, if desired, telegraphed time from Washington every day.

SCIENTIFIC SOCIETY.

At the meeting of the Rose Scientific Society, on Friday, February 1, two interesting papers were read. Mr. Sanborn, '96, read a paper on the "Formation of Tables by Method of Differences." The subject was illustrated by examples of series often met with in experimental practice. Decker, '96, presented an exhaustive paper on the "History of the Telephone," making each step in the development of the invention, and giving a diagrammatic representation of the improvements in the methods of sound transmission to a distance. The discussion following this paper was led by Professor Gray. Interesting points with regard to discussions of patent rights in this country, as well as in England, were brought out by Professor Gray.—RICE, '96.

HOW HE DID IT.

He swore that after New Year's day
  He'd take to early rising,
A bran-new leaf turn over, so
  It's not a bit surprising
That, when his faithful landlady
  To wake him nearly drove her
Knuckles through his chamber door,
  He sleepily *turned over*.

M., '94.

The Sophmores have had a quizz in descriptive.

Fry, '97, was visited by his brother from Texas recently.

Lufkin, '97, was in St. Louis recently having his eyes treated.

Rice, '96, is the Rose correspondent for the Indianapolis News.

Keeps on in spite of low temperature—the boil on Meyer's neck.

Albert L. Hebb, ex-'95, was shaking hands with Rose friends recently.

Hubbard, '98, leads the singing at the Congregational Sunday School.

Theobold, '98, has returned to school after an absence since Christmas.

Montgomery, '98, strained his ankle at the gymnasium a few evenings ago.

T. S. Bailey and T. C. Smith, ex-'95 men, will graduate from Purdue this year.

Troxler, Speed and Mundy were at Louisville last month working on their theses.

Walking is good from the fair grounds, especially after the last car has gone down.

Grey, ex-'96, did not go to Cleveland but is holding the position of assistant county trustee.

Hovey has grown a fine mustache since our last issue and would be taken for a Junior anywhere.

Prof. in French (oral translation)—"Whom do you love?"

Oscar—"Well now I would have to think about that."

The first four letters in answer to the circulars respecting the proposed gymnasium brought $50.

Some of the Sophs suspected treachery when certain frozen conglomerations were placed before them at the reception.

Patterson, '96, was observed carrying a fan in his overcoat pocket on the day the thermometer stood at 20° below zero. His object was probably suicide.

Gordon and Newbold, '97, have been on the sick list for some time. Both are off again however, and assure everybody that quaternions are worse than medicine.

Darst, '95, enjoys the study of political economy very much, but has some objections to not a few of Henry George's ideas and to Prof. Wickersham's idea of obtaining wool from cows.

A quantity of sample tobacco was distributed in the neighborhood of the Poly last week, to the sorrow of a number of our most exemplary Freshmen, who endeavored to conquer the weed.

Scott suggests to Prof. Wickersham a novel plan for acquiring the German language rapidly, viz.: by "associating ideas." That is, Eastwood develops the ideas (translations) and Scott "associates" them.

Brachmann has a scheme of undoubted merit for "fixing" the Sophs. He has purchased a large syringe and a quantity of ink, the plan being to load and fire the gun from behind a tree, the gunner making his escape under cover of the blue atmosphere. Hose pipe is said to be a mere plaything in comparison.

Last week a Freshman posted a notice on the bulletin board that the man who took his hat could get satisfaction by meeting him in the hall. Was he on the war-path or did his conscience forbid him to keep a better hat?

In order to develop a pitcher this year, of which we stand in sore need, the Athletic Association agreed to pay for all windows broken by throwing the ball in the basement. Little did they realize what they had undertaken.

There was an informal dance held at Duenweg's hall on the evening of the 2nd inst. The affair was gotten up by Poly's and most of the sterner sex present were of that persuasion. Quite a number of visiting young ladies were present and everybody had an exceedingly pleasant time.

Stilz had a narrow escape from a watery grave few evenings ago. Led on by a wild desire for the sport he ventured upon insecure ice at Kennedy's and broke through, but was saved by the timely arrival of friends. We strongly advise his confining himself to skating on the sidewalks in the future.

We had quite a cheerful little fire in the building back of the shops last month. A pile of wood was placed on the floor, saturated with oil, and ignited, but the automatic pump began working immediately, and the water which it supplied being up to standard wetness, the fire was promptly extinguished.

Our worthy ed-in-chief had occasion to work very late the other night, and the next morning he found the mucilage brush in the lamp chimney and his glasses in the waste basket; he cannot explain it, but attributes it to the fact that McDargh has been smoking cigars from a box that he won on the last quiz.

One of the boys who has a stand-in at Coates College says there is some talk of their organizing a field athletic team, to compete with Rose. Nothing, of course, could please us better, and we will see that the secretary sends them a copy of the constitution of the association immediately, urging them to enter the lists next May.

At the last Normal reception there was a take off on the Polys in the form of a definition of what a Poly really is. Their ideas of us are somewhat incongruous, but they seem to consider us a kind of a bird of green plumage, caged off in the north part of town.

The following has been submitted as a return compliment, and agrees perfectly with our experiences and observations:

Normals are divided into two classes, according to gender.

One class is recognizable by its characteristic greenish tint and its general resemblance to a book agent, or portable library.

The other class presents a more striking resemblance to the human species, and vary in perfection and development, from the missing link to a Venus De Milo (probably falling a little short of both extremes).

They flock together in great numbers in small habitations, labeled for convenience of reference, "Measles—Keep Out."

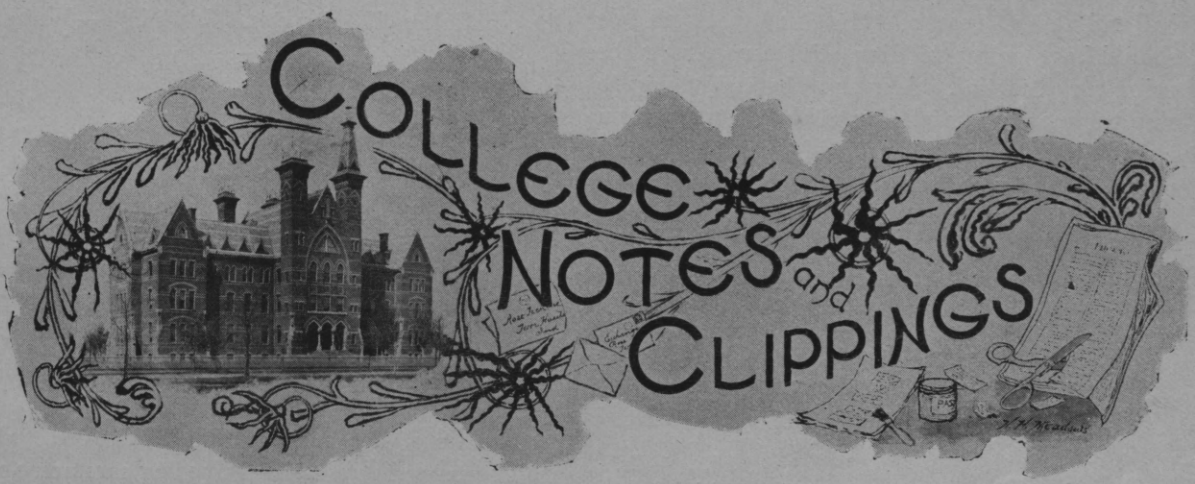
Harry Coope, who has been president of '96 since its organization, has recently left the Institute to accept a position at Cincinnati. The Junior class regrets deeply the loss in him of one of its most active members.

O'Brien, '96, is reported as having made a series of experiments to determine the heat conductivity of wood, and the Scientific Society may expect a paper from him soon in which he can give a description of apparatus and some interesting results. The tests made were upon drawing boards as bed covers during the coldest weather.

Two Sophomores who have lovely apartments on Sixth-and-one-half street were honored by a visit from several Freshmen on reception evening. The gentlemen were not at home when '98 called, but were discovered some minutes later in a secluded closet, praying that no untimely combination of events might preclude their attendance at church the following Sunday. By way of diversion from the routine of pleasantries that in-

variably occur on these "visiting" occasions, one of the hosts gave an exhibition in the use of the chair as a means of defense, and became so absorbed as to attempt vanquishing the guests. The Sophomore class was hastily telephoned for to reassure the callers of its talented member's utter harmlessness, but fearing that he might again grow oblivious the visitors withdrew, inviting the other host for a stroll down town. He was handsomely entertained at a tonsorial parlor and then taken back riding to his unbounded delight.

The capacity of the Terre Haute House was wholly inadequate for accommodating the banquet (?) held by the Sophomores on a recent Friday night. The difficulty was overcome by purchasing the supplies (principally liquid) in the neighborhood of Seventh street and the Van tracks and holding the festivities in the open air.



The University of California is thinking of sending its track team in the spring to the Chicago meet, instead of going to New York. The *Occident* says: Should Chicago be selected as the field of battle, no more than six athletes need be chosen, each of whom should enter two, perhaps more, events, easily winning ninety out of one hundred and twenty points in any competition west of the Alleghany mountains." We know that California has good athletes but we think they had better cut down those ninety points a few. However, we would like to meet them and have some comparison in track athletics as well as in football between the middle west and the far west.—*The Illini.*

In connection with the above we especially endorse *The Illini's* remark about cutting the ninety points down a few and we would go a little farther and say that if they come to the Terre Haute meeting they may be obliged to cut them down "quite a few," to use a slang expression.

The Harvard gymnasium will be enlarged. Increased bathing and locker accommodations, extensions of the physical director's office and the trophy room are to be secured.

The subject for the Cornell-Pennsylvania debate is: "Resolved; That the most effective means of restricting the liquor traffic is to eliminate the element of private profit." Cornell has the affirmative.

"Sweet maid," said he.
"I ask of thee
To fly, to fly, to fly with me?"
"Young fellow," said she,
"Now don't you be,
Too fly, too fly, too fly with me.—*Ex.*

The study of English, says the *Inter Ocean*, receives greater and greater attention at our institutions. Harvard now makes it the only required work in her whole curriculum. In 1895 English may be offered either as a preliminary or as a final subject. After 1895 the examination in English will occupy two hours instead of one hour and a half, as heretofore, and will count for two hours instead of one hour. It will consist of two parts, which, however, can be taken separately.—*College Folio.*

Walter Camp proposes three changes in the football rules next season. He thinks all officials should have power to disqualify any player for using rough tactics. Also that the easiest way to stop the mass plays is to prohibit the men from leaving their positions until the ball is put in play, and that a "down" should be given to the full back if he prefers it to a free kick.

An ugly day,
A little sleet,
Laughing school girl,
Tripping feet.
Smiles all gone,
Mirth subsided,
Street and maiden
Have collided.

—*Ex.*

Freshman to busy Junior.—"Say, which burns longer a wax or a tallow candle?"

Junior.—"I suppose a wax candle?"

Freshman.—"No, they both burn shorter." The Junior has exhausted two smelling bottles, and still breathes heavily.—*The Comenian.*

Now I lay me down to sleep
Upon my little bed;
If I should die before I wake,
How would I know I'm dead.

—*Ex.*

A large glee club to be composed of college graduates, is being formed in New York City for the promotion of musical and social intercourse among college students.—*Ex.*

Beloit college will be co-educational. Women will be admitted to full membership of the college at the beginning of the next school year.—*The Round Table.*

The trustees of Dartmouth college have formally accepted the designs of a New York architect for buildings to be erected on the proposed quadrangle north of the campus. Within three years the quadrangle will be completed with over $1,000,000 worth of building and will be the finest of its kind in the country.—*Crimson.*

"The mighty class of Sophomores amid the ascending smoke of unblemished betacombs and the burning of sweet incense, have sworn a solemn oath to the immortal gods, to neither shave their manly beards nor cut their flowing locks till after the conflict on Washington's birthday.—*Wabash.*

As Providence willed
By her bicycle killed;
'Twas thus that her epitaph ran:
"In bloomers and cap,
Though sad the mishap,
She went to her death like a man."—*Ex.*

The rhetoric class at the University of Michigan is engaged in collecting all slang words and phrases in common use. These will be published with definitions, together with a list of slang in use ten years ago.—*Ex.*

We congratulate our State University on the acquisition of her new building, Kirkwood Hall, which was dedicated with imposing ceremony on the twenty-fifth of January.

At his watch he looks intently,
While a smile lights up his face,
And I know as well as can be,
There's a woman in the case.—*Ex.*

Two new courses in Latin have been added at Wellesley, as has also a course in newspaper work.—*Ex.*

Williams college has a rule which requires attendance upon ninety per cent. of the college exercises.

The faculty at Amherst have decided that there shall be no more Freshman football teams.

There have been seven Harvard-Yale debates, Harvard winning each time.—*Ex.*

Princeton has refused Pennsylvania's challenge for a dual track athletic meeting this spring.